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The characteristics of Loop-node-occupation and its application to network classification

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Loops, which can be found in many different kinds of networks, it is important in many aspects, such as when dealing with spreading dynamics on networks, calculating network dimensions, etc. On the contrary, tree networks in which no loop exits, are simplifications and usually allow for analyticity. There lacks a quantity, however, to tell the ratio of loops which determines the extent of network being close to tree networks. Therefore we introduce the term “Loop Nodes Occupation” (LNO) to describe the ratio of number of nodes belonging to loops to the number of total nodes, and provide an algorithm to calculate LNO. LNO is studied in both network models and real networks. The LNO remains unchanged in different sized ER networks with the same average degree, and increases with the average degree, which yields a critical turning point. The approximate analytical solutions of LNO in ER networks were given, which fits the simulations well. The critical phenomenon is explored by analysing the giant component of networks. We compare the LNO in network models and real networks, and find the latter is generally smaller. The method is also applied to four different kinds of transportation networks and fungal networks, which gives rise to different zones of effect. It is interesting to see that LNO is very useful in network recognition of machine learning.

Publications

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